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Location-Based Computing: Wherever You Go, There You Are

BY KEVIN WERBACH

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However much time we spend in cyberspace, we still live our lives in the physical world. And one central aspect of that world is that it has spatial dimensions and variety. We move from place to place, and as we do our experience shifts. A supermarket is different from your kitchen, which is different from a restaurant, though you may be near food in all of them.

Computers have traditionally lacked the ability to influence and be influenced by the surrounding environment. With the growth of location-sensitive services and applications, the physical and the virtual are merging. Location-based computing is becoming real thanks to advances in mobile devices, wireless connectivity and location-detection technologies. In this issue, we examine several developments in this area, including mobile city guides; global positioning system (GPS) and wireless phone triangulation technologies; location-based e-commerce; and context-sensitive applications for cars, vending machines and elsewhere.

We often use spatial metaphors to describe our computing experiences. We travel from our home page to another site on the Net. We open windows, enter chat rooms and explore virtual marketplaces. We click on the "back" button in our browsers, move from site to site, go into cyberspace, navigate. Despite this, the Net isn't a place . . . at least not in the same sense as a real-world room or highway. It may be self-contained for legal or other purposes (though this gets into sticky and unresolved jurisdictional issues). But it is different in important ways from physical reality.

{ *continued on page 2* }

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Wherever you go online, you're also where you just were, or just a click away. And you're one typed URL away from *anywhere*. And though the content changes as you surf the Web, the omnipresent browser frame remains in place, anchoring the experience to your screen. If anything, the Net has *too much* context. Its malleability and interconnectedness can make it seem like a vast hall of mirrors, with no fixed points against which to orient oneself. If we experience the world as a Cartesian space, with ourselves at the 0,0 point, the Net is the abstract Euclidean thought space, where every point is the same as every other.

At the same time, computers as objects have traditionally been heavily place-bound. Until laptops became sufficiently light and affordable over the last decade, computers didn't move much at all. They stayed in place but had no real connection to those places. And laptops, though mobile, don't change context or function as we transport them from location to location. *(Esther Dyson, who spends much of her time traveling, says she loves seeing New York time on her laptop despite sitting in Moscow or Tokyo.)*

In the future, though, the way we think about computers will change. Some features will always be useful, but certain content and applications make sense only in specific physical locations. Devices and networks will become smart enough to identify those locations and change accordingly, and location-based computing will grow beyond the city guides and mapping services available today.

As computers become more a part of daily life, we will gradually think of them less as technologies and more as mundane tools. The refrigerator, the wristwatch and the automatic transmission are all sophisticated technologies that affect millions of lives, but today we take them for granted. We do so, at least in part, because we feel that the tools are adapted to us, rather than vice versa. We think we understand how they work (though we probably don't) because we know what they do and the limited ways we can manipulate them. We have a mental model of their operation. Personal computers have a long way to go before they reach this point, but location-based services are one way they will move in that direction.

Coming Soon to a Location Near You

Several inexorable trends are driving the development of location-based computing. The first is the price-performance curve of Moore's Law. Smaller, lighter, faster, cheaper devices are easier to take with you, to design for specific location-sensitive purposes, and to build with the intelligence necessary to change context on the fly. The second important trend is ubiquitous connectivity, thanks to the Internet and the growth of digital wireless networks (SEE **RELEASE 1.0**, APRIL 1999). With connected wireless devices comes the possibility of tracking where those devices are, either through network triangulation or global positioning system (GPS) receivers built into handsets (SEE PAGE 6).

The third important factor is social rather than technical: growing desire to merge the best elements of the physical and virtual worlds. The convergence of the real and the virtual, a central theme of this year's PC Forum (SEE **RELEASE 1.0**, MARCH 2000), has several manifestations. These include click-and-mortar hybrids of established retail businesses and e-commerce; embedded smart chips in credit cards, clothing, packages and even people; and simulation software that models complex phenomena such as crowd dynamics. As Scout Electromedia cto Bill Cockayne (SEE PAGE 19) notes, "The question becomes 'when is location information useful to users?' as opposed to the normally heard 'how can I develop a service based on location?'"

We're becoming more comfortable with the idea that computers come with us wherever we go, whether in the form of laptops, handhelds, mobile phones, MP3 music players, or something else. A computer that sits in a room somewhere, forcing us to enter its world and adapt to its conventions, is starting to feel old-fashioned, bringing to mind the 1960s mainframes locked in their climate-controlled rooms and tended by an exclusive cadre of technical high priests in white robes. Truly personal computers should adapt themselves to us, shouldn't they?

All this puts a premium on services designed around places rather than devices. Location-based computing means rethinking content, applications and interfaces, because many of the assumptions that made sense on the desktop no longer hold. Time tends to be at a premium in location-specific situations. You're using the service, in most cases, because you want to get something done on the spot. If you're trying to find the nearest ATM or to book movie tickets, you always have the alternative of going the old-fashioned route and simply walking around or asking people.

People certainly understand location in concrete terms, but they also bring in a series of fuzzier, more contextual parameters.

For purposes of this issue, we separate location-based applications and devices from the communications infrastructure (input, output and connectivity) supporting them. We discussed voice interfaces last month (SEE **RELEASE 1.0**, MAY 2000), and the personal-area wireless networks and protocols that get information onto mobile devices last year (SEE **RELEASE 1.0**, APRIL 1999).

Where am I?

Location is one of those concepts that means something different to a machine than it does to a person. Computers conceive of location, like everything else, in hard-edged quantitative terms: a set of coordinates in a Cartesian matrix, tracked on scales such as latitude, longitude and altitude. An object five miles away is farther than one 200 yards to my left.

People certainly understand location in these concrete terms, but they also bring in a series of fuzzier, more contextual parameters. If I'm on the East Side of Manhattan, the restaurant that looks closer to the computer may be in Brooklyn. Unless I have a helicopter handy, the distance to the nearest bridge or tunnel has to be factored in. Similarly, a three-mile drive down a four-lane highway takes much less time than the same drive over a winding dirt road . . . unless it's rush hour in Los Angeles.

Sometimes relative location is more important than absolute coordinates. We often give directions based on landmarks or neighborhoods, rather than the pure distances computers typically provide. Scale also matters. The concept of where you are, and what's near you, changes dramatically depending on whether you're walking, driving or flying. Moreover, despite the axiom of geometry that all points are equal, some points in real space are surely more equal than others. I'd go farther for a good doctor than for a good pizza (though some people I know would do otherwise).

Though not identical, these subtleties resemble the challenges researchers face designing mobile robots. It sounds simple enough for a robot with a digital camera for eyes and a room map for a brain to avoid crashing into things, but in practice building such a

robot has proven very difficult. And context will always matter: How could a robot domestic servant learn to dust only where the guests will see? Of course, the Internet location-based services now coming on the market don't attempt anything nearly so sophisticated. They are limited to particular topical and geographic domains where a bit of location data is enough to deliver useful services. Still, it's important to keep in mind that it's far harder to implement workable services than to dream up potential uses for location-sensitive mobile devices.

Location application sensations (sweeping the nation)

Several different applications fall into the location-based computing category. The most obvious are navigation services, which identify nearby businesses or deliver directions from the current location. Mobile navigation picks up where maps and guidebooks leave off. These services can be delivered as applications on general-purpose mobile devices such as the Palm, integrated with specialized hardware, or provided as value-added services to mobile phones.

Though today the focus is primarily on information content, mobile commerce is not far off. For example, walk by a McDonald's, get a coupon for a hamburger . . .or a coupon for the Burger King on the next block. Walk into the McDonald's and get an offer of a free lunch if you first buy three or more CDs from the store next door. This raises a host of questions about privacy, effective marketing techniques and business models, which companies will confront as they roll out mobile-commerce services.

Another class of location-based applications are context-specific solutions, which make sense only in certain places — vending machines, hotels, and supermarkets, for example. Some applications, such as comparison shopping, take on unique value in these environments. However, each location may be too small a portion of a person's time and interest to justify a special mobile device.

And then there are the killer apps we can't predict in advance. The combination of widespread geocoding (tying absolute positions such as latitude and longitude to addresses, businesses and other relative identifiers) and location-sensitive mobile devices will create a fertile field for innovation. "Basically, all the world around you is going to be in [geocoded] databases, and you're going to be walking through these electronic yellow pages," predicts GeoVector coo Pam Kerwin (SEE PAGE 20).

InfoUSA.com, for example, which sells aggregated information gleaned from yellow pages directories and other sources, has addresses for 10.8 million businesses and

points of interest in the US in its database. In addition to geocoding that data, it's sending photographers out to take pictures of retail establishments. The images will be associated with the location data; with improved wireless data services they will even be accessible on mobile devices. Even more interesting, the photographers carry GPS receivers to collect accurate latitude/longitude readings for each business.

The proliferation of mobile devices that know where they are and have wireless communications capabilities will create a positive feedback loop that opens up even more possibilities. Hundreds of millions of location-aware mobile phones and personal digital assistants (PDAs) effectively become a global real-time yellow pages, travel guidebook and more, all rolled into one. Much as Internet services providers and meta-services networks such as Akamai (SEE **RELEASE 1.0**, DECEMBER 1999) monitor traffic flows on their networks, it will be possible to model highway traffic based on real-time datapoints from mobile phones and embedded GPS receivers in cars.

We're far away from figuring out all the technical details and policy implications of such services, and it will take time for the necessary infrastructure to be deployed widely enough (SEE PAGE 9 ON E911). Once the pre-conditions are in place, though, we expect innovation to occur quickly, much like the explosive growth of the Web.

Automatic Position Identification

Though location-based services don't require devices that know where you are, there's no question such a feature enhances the experience. But how should the device get that information?

One way is for users to identify their location, such as by selecting cross streets from a menu. That, however, requires a manual step, which can be difficult if the device doesn't have a good input method. It also means the device doesn't have a continuous, storable record of its position, which rules out a whole class of services. Moreover, in some cases users don't know where they are, so asking them isn't helpful.

Gee! No, GPS

There are two primary mechanisms for determining the location of a handheld device: global positioning system (GPS) and network-based triangulation. The US military developed GPS to help it locate its equipment and people, but the system

quickly found significant civilian uses. GPS satellites orbit the earth in a configuration that means a person anywhere on the planet with a clear view of the sky above generally can track the signal from at least three of them. Receiver devices determine their location by measuring arrival time from each signal source.

Until earlier this year, the US government deliberately introduced errors into the GPS signals so that civilian — or "unofficial" or *unfriendly* military — applications would not be able to match the accuracy of military users. However, President Clinton announced in May that the scrambling would end, allowing commercial GPS receivers to achieve accuracy within about 10 to 15 meters compared to 100 meters previously.

GPS is already popular for boating and hiking, where a near-exact exact position, especially when overlaid on an electronic chart or map, can be extremely valuable, even life-saving. The system does have some limitations. Because its signals come from satellites orbiting many miles above the earth, they are relatively weak. GPS doesn't work particularly well indoors, and may have problems in dense urban areas. However, other than those limitations, GPS works *everywhere* in the world, without any additional network connection.

Hardware vendors are working to make GPS chips and receivers lighter and cheaper. Today adding GPS to a car or boat adds insignificant overhead. (GPS is a key element, for example, in GM's Onstar in-car navigation system.) For smaller devices such as laptops or PDAs, however, GPS is harder to justify. But that too is changing, thanks to companies such as GeoDiscovery.

GeoDiscovery: the real geo

GeoDiscovery is creating the building blocks for new services by integrating content with GPS and with a location-oriented metadata language it calls GeoXML. Existing location-based applications on handhelds have some value, explains vp of marketing Brian Sevy, but "just by nature when people are traveling in an unfamiliar place, they don't know where they are — that's why they are asking for directions."

GeoDiscovery's founders think the key is for devices to know where you are, and to combine that knowledge with existing data such as your schedule or your car-rental reservations. GeoDiscovery recently began the private beta of its service to test the integration of its software and hardware with Handspring devices. It plans to launch in the fall.

Based on the extensible markup language (XML), GeoXML handles attributes and other information associated with pure coordinate values for location. It also supports representations in many formats including photographs, video, drawings, models and maps. GeoDiscovery has ten people building vector models for geographic features that don't currently have them. Those models are then linked, using GeoXML, to descriptions and other information. "We want to make it second nature to geocode any content that's produced," says vp of marketing Brian Sevy.

For example, an interactive travel guide could include maps that automatically display your current location and orientation in context with descriptions and pictures of relevant locations. Users could turn categories of information on or off, and could click on anything they saw on the map to browse additional material. GeoDiscovery is also working to integrate location-based information with personal information managers (PIMs). It plans eventually to be able to geocode a person's address book or calendar automatically, so that any time that person selects a contact or a meeting the location would automatically appear on a map.

GEODISCOVERY INFO

HEADQUARTERS: Orem, UT
FOUNDED: July 1998
EMPLOYEES: 27 full-time and 9 to 10 contract geo-technicians
FUNDING: Angels; currently raising first round
URL: www.geodiscovery.com

"Our focus up to this point has been to structure the data so we could deliver it to a mobile device or a wireless phone," says ceo Doug Snapp. He adds, however, that there has been significant interest from publishers in other formats, such as Adobe Acrobat (PDF) and electronic book formats. Because GeoXML is agnostic about presentation methods, it allows publishers to have a single data model but to deliver content in a variety of media.

GeoDiscovery will generate revenue by licensing its server software to portals, wireless operators and others. The servers handle the back-end geocoding and interpretation of GeoXML-based information, as well as integration with e-commerce. Snapp anticipates that some customers will license the entire platform and incorporate their own content into it, while others will provide content that GeoDiscovery will process and handle through a clearinghouse model.

In addition, GeoDiscovery is developing hardware to identify and integrate location attributes with other services. Its first product is an inexpensive GPS receiver and digital compass, the Geode, that will plug into the expansion slot of Handspring PDAs. The Geode will work with software so that its data plugs into dynamic maps and other applications. GeoDiscovery will license the Geode to others, and it's also developing other hardware sensors for different types of location data.

Sevy says the combination of integrated GPS and GeoXML creates a bi-directional model, in which users consume location-based information but also create it as they move around and capture data. "The Geode hardware allows them to take advantage of any information they capture on that device whether it's text or a digital photo or a sound recording. All that information is geocoded and in GeoXML format natively," he states. From there, the next step is to incorporate community. GeoDiscovery wants to allow individuals to share location-based information they develop, such as a hiker sharing detailed real-world information about a great hike.

E911 requirements in the US

Mobile phones are by far the most popular handheld information device, and new generations of phones offer email and Web access, among other services. A mobile phone needs to find and communicate with the closest transmission tower on its network in order to function, but those towers may be a significant distance apart. Wireline phones have a fixed location, so the originating phone number (which is automatically passed through the SS7 signaling network, SEE **RELEASE 1.0**, DECEMBER 1999) can be matched against an address database to determine location. A mobile phone, however, is *mobile,* so knowing the originating phone number doesn't tell anything about the location of the phone at that particular moment.

One consequence of mobile phones' lack of built-in location identification is that there is no way to determine where someone is calling from when they dial for emergency assistance (911 in the US). This problem is made more difficult by the variety of different transmission technologies that mobile carriers in the US use. Approximately one-third of 911 calls in the US are made from mobile phones, because many emergencies occur when people aren't at home or near a landline phone. Emergency services operators' inability to determine the location of these callers is a serious impediment to life-saving services.

To address this problem, the US Federal Communications Commission (FCC) in 1994 sought comment on whether to require the wireless industry to implement enhanced 911 (E911) location services. The FCC eventually mandated that wireless carriers implement E911 in two phases. The rules contain several conditions and caveats, but the general requirements are as follows. In the first phase, with a deadline of April 1998, carriers must be able to pass to emergency service providers the originating phone number and the cell site that handled the call, which narrows the location to a general part of a city. By October 2001, carriers must be able to locate a

phone to within 50 to 100 meters for two-thirds of calls, and 150 to 300 meters for 95 percent of calls.

To operate, wireless E911 services require upgrades both from the wireless carriers and from public safety access points (PSAPs), the enhanced call centers that answer emergency information calls and route information to assistance providers such as the police or fire departments. These centers are not regulated by the FCC, so the agency can't require them to upgrade. The wireless E911 implementation rules have thus been written so that a wireless carrier must implement E911 when a local PSAP upgrades its own systems and requests that the carrier do the same.

Location identification companies

There are two basic ways to meet the E911 location requirements: network-based and handset-based mechanisms. Network-based solutions use some variation of triangulation from multiple towers. By determining the proximity of each tower based on the radio signal to the phone, the phone's location can be pinpointed. Handset-based systems use a mechanism in the handset to determine location independent of the wireless network. GPS (SEE PAGE 6) is the predominant form of handset-based location identification.

Network-based approaches generally work with all existing phones, and they can function in essentially any location where the phone gets reception. There are several variations including time difference of arrival and angle of arrival that use different algorithms to calculate location from the dispersal of radio signals in the network. Handset-based approaches do not involve the same expensive network-wide upgrades, but they suffer from the limitations of GPS and require users to purchase new phones. Some solutions use a combination of both approaches, with the wireless network providing a general location and GPS data incorporated for precision.

Several companies are jockeying to provide the technology for wireless E911. The leading contenders have demonstrated their systems in limited trials and have also built features to address privacy issues and other concerns. Already there has been consolidation in this space, with Snaptrack (a leading provider of GPS-based technology assisted by the wireless network) selling to Qualcomm for about $1 billion, and network-based technology provider TruePosition acquiring KSI, which uses a different technical approach in the same general category. TruePosition itself is now part of Liberty Media, controlled by former TCI ceo John Malone, pursuant to Liberty's acquisition of the Associated Group last year. Other competitors include

IDC and Cell-Loc. Some of these companies generate revenues today supporting phase-1 wireless E911 services (passing cell tower and phone number information), but the big prize will come when phase 2 takes effect.

In addition to the location-identification companies themselves, there are middleware providers that take the data and integrate it with the wireless carriers' and the PSAP's systems. These companies, which include SignalSoft and XYPoint, also see non-emergency services such as mobile commerce as huge opportunities they can enable once wireless E911 capability is rolled out.

The FCC rules obligate carriers to specify by October 2000 how they will comply with the E911 requirements, even though the systems need not be in place for another year. The FCC's E911 mandates are focused on emergency services, but once the network capabilities for location-based services are in place, they will support many other offerings. In fact, carriers have an incentive to deliver value-added services that can be billed at higher rates than voice calls, while the E911 service is one for which they are simply entitled to cost recovery. The FCC's mandates apply only in the US, but other countries are watching the E911 developments and may impose similar requirements. Even if they don't, the potential for new services based on location-sensitive mobile handsets are causing wireless carriers to explore similar services in other markets.

Despite all these developments, it's worth noting that wireless carriers in the US have not rushed to deploy location-identification technologies. If anything, they have dragged their feet. It's difficult to understand why, when they are entitled to cost recovery for the investment to provide E911 functionality and surveys show most customers would be willing to pay a surcharge to support this capability.

Some of the problem may be that the new location-based services that the infrastructure upgrades will support are largely hypothetical today. Another issue is that E911 in the US is taking place as an FCC regulatory requirement, making a tasty morsel for carriers feel like a bitter pill. Carriers, whose natural instinct is to seek total control over the customer, may worry that location-based services require open interconnection and third party content that they can't control.

GEOTOUCH: THE NEXT GENERATION OF ONLINE MAPPING

Online mapping sites have proven popular, with MapQuest, for example, delivering over 130 million maps in December 1999. However, the maps these services provide are generally static and difficult to correlate with points of interest such as subway stations or hotels.

GeoTouch, a startup in Palo Alto, CA, has developed a new online mapping technology designed to integrate location-based information seamlessly into the mapping experience. GeoTouch's maps feature interactive pan and zoom, and they are integrated with a location-based search engine so users can locate various kinds of sites (restaurants, stores, entertainment, and so forth). Select a category or individual location and an icon shows up on the map; pass your mouse over the icon and a box displays identifying information. Users can even select two points on the map and measure distance between them. Because GeoTouch uses Java servlets, the maps update without the annoying page refreshes of most other mapping sites.

At the core of GeoTouch's services is spatial indexing technology that allows the company to build a scalable database of location-tagged information for display on its maps. The goal is to enable users to find local information using the familiar spatial metaphor rather than keyword search that current online city guides rely on. Similar to MapQuest and Vicinity, GeoTouch plans to generate revenue by licensing its technology to other sites, through targeted advertising and through fees for listings and e-commerce referrals.

GeoTouch will initially be available on the Web, but a wireless version is planned for the third quarter. Current mobile devices don't have the screen resolution or wireless bandwidth to take full advantage of GeoTouch's rich color maps, but the company believes it can deliver useful services even with current wireless access protocol (WAP) interfaces.

GeoTouch was founded by Sri Palasamudram, previously a project manager at Autoweb.com. It has brought on MapQuest founder Barry Glick as an advisor and plans to launch its consumer Website in September. The company has raised $8 million from Redwood Partners, Gabriel Ventures and Alliance Ventures.

Mobile Navigation Services

Several companies are pushing ahead with location-oriented services that don't require automated positioning information. Today only a small number of users have wireless or GPS-enabled devices, compared to 7 million who have Palm PDAs. Consequently, there's an opening to deliver location-based information on existing platforms with an evolution path toward wireless and automatic location detection in the near future.

Ever wondered whether there was a good Chinese restaurant near the movie theater you just walked out of? Or where and when a particular movie was playing in your neighborhood? This kind of information has long been available in newspapers and city guides, if you can find it, as well as through local information Websites such as Ticketmaster-Citysearch and AOL's Digital Cities. But there's a big difference between seeing the information while sitting in your living room and pulling it up (organized by distance to your current location and start-time) while standing on a street corner. Some of the online local guides can transfer information to a Palm device, but specialized applications can deliver a better user experience.

Some of the information these location-based services offer is also effective delivered by voice. Voice portals such as Tellme and BeVocal (SEE **RELEASE 1.0**, MAY 2000) provide restaurant listings, directions and other content to wireless phones, eliminating the need for a PDA. In some contexts these services are the best approach, but in other cases voice is not the ideal interface. You can't scan a list of choices through a voice interface in the same way you can on a screen, for example.

Vindigo: you can take it with you

Vindigo was founded by ceo Jason Devitt and cto David Joerg, both of whom previously were part of the equity derivatives group at D.E. Shaw, an investment bank known for its heavy use of quantitative trading methods. "We saw a future where there would be devices priced for the mass market that would be on the Internet all the time," says Joerg. "We thought a lot about what a device like that would be used for." After communications-oriented services, the two concluded that timely location-based information was a potential killer app for mobile devices. "A service has to be really compelling to get people to change the way they live, to change their habits," Joerg notes.

Vindigo launched in New York in March, and in Chicago, Boston, San Francisco and Washington, DC earlier this month. Though at first glance it seems like a fairly simple application, Vindigo uses some sophisticated programming to compress the application by roughly a factor of four without cutting too far into functionality. The initial release of Vindigo runs on Palm devices, many of which have only one or two megabytes of memory. The Vindigo application for New York covers thousands of different sites. It comes loaded with restaurant reviews licensed from Zagat or the *New York Times*' New York Today, and takes up just 595 or 695 kilobytes depending on which set of reviews is included.

VINDIGO INFO

HEADQUARTERS: New York, NY
FOUNDED: June 1999
EMPLOYEES: 26
FUNDING: $9 million from General Atlantic Partners and Flatiron Partners; equity investment from Zagat
URL: www.vindigo.com

When asked about details of Vindigo's compression techniques, Joerg demurs, pointing to the company's pending patent application. He does say, "We had to rethink how compression and decompression are done on mobile devices." Traditional techniques don't factor in the size of the compression engine itself, for example, but in Vindigo's case the compressor/decompressor is also subject to the memory and processing-power limitations of the mobile device. Vindigo's text compression algorithms are optimized for the type of information it delivers, but not for a specific device, making it portable to other platforms with similar performance.

In early development versions, Vindigo licensed yellow pages information. However, says Joerg, electronic yellow pages databases are about 40 percent incorrect and 18 months out of date, and users are much more demanding of local content in a mobile environment: "People are using the information you give them to make real decisions right now. If you direct them to some place that's closed, they're going to throw away the device. You only have to waste someone's time like that once or twice and it's over." Yellow pages information also lack qualitative information, such as reviews and ratings.

Vindigo now licenses its content from providers including Zagat, Inshop and the *San Francisco Chronicle*, and it also allows users to submit their own comments and ratings. So far users have submitted 40,000 restaurant reviews, half of which include comments in addition to numeric ratings. That material, along with anonymous statistics about what locations and destinations users search for, is automatically sent to Vindigo's servers when users synchronize their Palm devices to obtain new content. Joerg says the user reviews help enhance the accuracy of the service, provide value to the content providers (who don't charge Vindigo because it gives them additional brand exposure) and potentially form the basis for additional revenue streams.

FIGURE 1: *Vindigo main screen and navigation interface.*

Vindigo currently generates revenue through advertisements that show up periodically at the bottom of the screen. The ads are targeted by location and type of activity the customer is interested in. The company estimates it has delivered over 2.5 million impressions in the few months its New York guide has been available, with a user base now nearing 60,000. The Vindigo application can be beamed via infrared to another Palm user; about 20 percent of Vindigo's users first got it that way.

Going forward, Vindigo will expand both the cities and the handheld platforms it supports. It plans to launch the first wireless version of its service in the third quarter. However, Joerg says integrated location detection is not essential to the service, because many people use it to plan ahead, in which case knowing where a device is right now isn't helpful.

CitiKey: Europe has mobile content providers too!

CitiKey launched its first mobile city guide, a Windows CE application covering Stockholm, in February 1999. It added London and Paris guides this month and now supports Palm OS as well as WAP-compatible mobile phones. The company plans to launch in 22 cities this year, including Europe, Asia and North America, the latter putting it in direct competition with Vindigo. CitiKey develops its own content optimized for mobile delivery. The service lists information on bars, restaurants, entertainment, accommodations and shopping, all updated weekly; the company plans additional content as well as position-sensitive information in the future.

CITIKEY INFO

HEADQUARTERS: London, UK, and Stockholm, Sweden
FOUNDED: October 1998
EMPLOYEES: 56
FUNDING: $11.5 million from Crescendo Ventures, Atlas Venture and Kennet Capital
URL: www.citikey.com (WAP site at wap.citikey.com)

Founder Ziad Ismail came up with the idea after having difficulty finding a place to go with friends in Stockholm. He later brought in Sushant Gupta, who had been with the telecom consulting firm Monitor, as ceo. Gupta says tying information such as city guides to the user's location is essentially a form of personalization, because it gives users exactly what they need at a particular time, in a particular place. "People are going to find themselves — even on the road — with far more complete and powerful information than they have today," he predicts. To deliver an effective service, he continues, requires expertise with mobile devices, networks and servers; CitiKey intends to be strong in all three areas.

CitiKey, like Vindigo, tracks usage and solicits customer feedback to improve its service. Gupta notes particularly strong demand for integrated maps. He sees location-detection technologies significantly increasing the takeup of mobile city guides and related services. CitiKey is developing APIs to incorporate automated location data into its application.

From its base in Europe, CitiKey naturally is focusing heavily on wireless. Gupta sees this as an important advantage over Vindigo and other potential competitors. "The whole market is going wireless, and there location will play a major role," he says, adding that CitiKey's relationships with mobile operators and handset vendors, as well as its familiarity with numerous protocols and device form factors, will be valuable assets as wireless becomes a bigger part of the market. Gupta

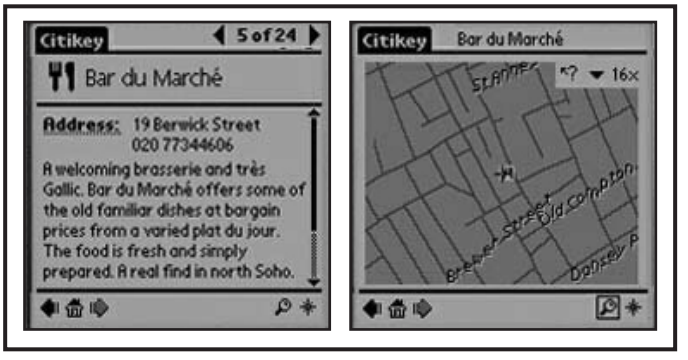

FIGURE 2: *CitiKey information screens (Palm version).*

also emphasizes that CitiKey supports multiple device platforms, and that its synchronization software ensures that information entered through one interface is propagated to the data on all of them.

The company will generate revenue from a combination of targeted advertising and transaction-based fees as it adds e-commerce functions. Gupta sees deals and conflicts between mobile operators and service or content providers, including portals, shaping the location-based services market for the near future. The major portals are moving rapidly into wireless, but operators have a strong position with regard to phone-based services because they control the layout of the very small display screens on handsets.

Airflash: not a flash in the pan

Airflash was among the first companies to deliver a mobile portal when it launched last July. Since then, the company has shifted from being primarily a destination site for mobile users to serving as an application service provider for wireless carriers, content providers and others who wish to incorporate location-based services. Its first major customers are the Finnish phone company Sonera and Excite@Home, both of which have active mobile portal initiatives. This month Aiflash announced British mobile carrier Orange as another customer.

AIRFLASH INFO

HEADQUARTERS: Redwood City, CA
FOUNDED: July 1998
EMPLOYEES: 60
FUNDING: $1.6 million from Band of Angels, Bay Partners, PTI, Trio Investments, Pitch Johnson; equity investment from Inktomi
URL: www.airflash.com

Currently Airflash offers directory services (location-based yellow pages and white pages lookups), entertainment (such as movie, theater and event listings, as well as an ATM locator), travel (including flight listings, hotels and rental car locations), driving directions and mobile comparison shopping. Most of these integrate mobile commerce, allowing users to make purchases directly from devices once they find the right destination. "A portion of the shopping experience is going to happen on the phone. Particularly with impulse purchasing," says Airflash ceo Rama Aysola.

Airflash's key technology is SmartZone, which merges generic coordinate data with real-world conditions such as natural and man-made barriers. This allows Airflash to identify the closest store or ATM, for example, in terms of driving or walking time, rather than specify locations that may be closer in distance but take much longer to reach. Current implementations rely on users to enter their present Zip code, but Airflash has designed its services to handle automated location identification (SEE PAGE 9) once it is widely available.

In March, Airflash announced a partnership with Inktomi to integrate its content with Inktomi's shopping, directory and search engines. Inktomi also made an equity investment in Airflash at that time. Location-based services may require significant computation and distributed processing to deliver the right information to the right location, and those are the kinds of problems that fit Inktomi's expertise (SEE **RELEASE 1.0**, DECEMBER 1999).

Aysola was a founder of Internet mapping information provider Vicinity, and before that an early employee of networking equipment vendor StrataCom. He founded Airflash in 1998 because existing providers such as Vicinity neglected the wireless opportunity. Though many of the services Airflash offers are similar to those available through Web-based navigation sites, Aysola says the context changes everything: "It's a sense of urgency. When you're looking for a hotel on the Web, chances are you're planning a vacation for next month. When you're looking for a hotel on the phone, chances are you've just arrived at the airport and you're sleepy, and you want a hotel right now." This means search is especially important, he continues, which is why Airflash has concentrated on making its search results very relevant.

GeePS: location-based services for merchants

GeePS is a wireless application service provider focused on retail applications. The three founders came from IT development firms that built back-end merchandising, retailing and enterprise resource planning systems for large retailers such as Polo Ralph Lauren and Toys 'R Us. In helping brick-and-mortar companies develop strategies to take advantage of e-commerce, says ceo Andy Goren, "we looked very carefully, and started seeing that it wasn't that they weren't getting it; it was that there was no medium for them to get." The Internet doesn't understand concept of time and space, but these are absolutely critical to physical-world retailers.

GeePS was founded to bridge this gap. The company has built a set of hosted services that allow retailers to communicate with consumers using wireless, location-sensitive devices. For the merchants, this means much more than popping up coupons on mobile phones, explains Goren: "What we're trying to bring to these people is dynamic interaction with their customers." To do this, GeePS integrates with back-office decision-support systems, point-of-sale systems, and other IT infrastructure that merchants use today to optimize their marketing and merchandising decisions.

GEEPS INFO

HEADQUARTERS: Cranbury, NJ
FOUNDED: August 1999
EMPLOYEES: 30
FUNDING: $2 million from Cupola Investments
URL: www.geeps.com

For example, Amazon.com could offer users a discount coupon on their handheld devices whenever they walked into a Barnes & Noble store. Or a GeePS-enabled department store could automatically send a customer a message when a pair of pants had been hemmed and were ready for a pickup, with an integrated coupon. Or a pharmacy could remind users to refill prescriptions when they were in the area.

GeePS is also partnering with portals and with publishers such as Advance Publications, which owns the Conde Nast magazine group. "We see merchants as just another portal," says Goren. Merchants will be listed for free in the GeePS information service, but will have to pay either based on advertising impressions or revenue sharing for location-based coupons, promotions and messaging.

GeePS intends to integrate its technology more tightly into merchants' decision-support systems, so that, for example, it could tie location-based promotions to available inventory. It will roll out its initial services later this summer with customers such as malls as well as Advance Publications.

Location-Centric Devices

Deploying location-based services on general-purpose hardware such as phones and PDAs reduces costs and avoids the need for an additional device. However, no device is ideal for all contexts. Mobile phones and Palm devices are themselves limited-function adaptations of more comprehensive devices that succeed in the mobile environment because they meet a specific set of needs efficiently. Efforts to combine phones and PDAs into a single device, such as Qualcomm's pdQ Smartphone, have generally flopped.

Are there other classes of services that would justify carrying around yet another device? Even if not, specialized hardware can be incorporated into existing devices through expansion slots, or built into the chips and firmware of next-generation units. When the size and price of GPS receivers falls below a certain threshold, they will become a standard component of certain types of mobile devices. Even before then, there are ways to add hooks for location-based services that enhance the value of those applications. Companies such as GeoVector (SEE PAGE 20) are working with hardware vendors to make new features possible.

Scout Electromedia: information a la Modo

"How many times have you stood at a corner in your home town or in Gotham wondering where a coffee shop, a store selling umbrellas, or an ATM was?" Scout Electromedia cto Bill Cockayne asks rhetorically. Devices able to answer those questions effectively as "a trusted friend who knows a few things about where you are," he continues, will be adopted rapidly.

Scout is taking a unique angle on location-based computing, reflected in the neologism "electromedia" that is part of its name. Combining electronics and media, Scout intends to create inexpensive, wireless devices that deliver location-specific content. "We looked at all of the problems related to wireless and mobile solutions — high-cost devices, outrageous monthly fees, ugly products, commodity information, bad displays, confusing navigation, synchronization or configuration — and set out to fix them," explains Cockayne. In addition to Cockayne, previously a researcher at DaimlerBenz, Scout's founders include ceo Geoff Pitfield, who came from California engineering firm Light and Motion Industries, and Dan Bomze, who has experience at IDEO and other product design companies.

SCOUT ELECTROMEDIA INFO

HEADQUARTERS: San Francisco, CA
FOUNDED: January 1999
EMPLOYEES: 60
FUNDING: $22.5 million from idealab!, Chase Capital Partners, Flatiron Partners, Techfund Capital
URL: www.scoutelectromedia.com

The company showed prototypes of its first device, the Modo, at this year's PC Forum. Modo, which will sell for under $100, will offer local city guides automatically updated through a paging network connection. (Scout will also generate revenue through advertisements delivered to the devices.) Because it uses an inexpensive, low-bandwidth paging network to deliver the content, Scout can sell the devices for a flat up-front fee and avoid service contracts, monthly billing, usage charges and the other impediments of most existing wireless-based services. Modo will be sold through retail outlets such as record, book and fashion stores, a further divergence from the normal communications and computing distribution channels.

The initial Modo rollout this summer will offer content for New York, Los Angeles and San Francisco, providing entertainment and event listings created in house by Scout to appeal to an urban audience in the 22-to-34 age range. The information can be viewed in multiple ways, with location as either an output ("I want a nearby Japanese restaurant") or an input in the case of requests to other users ("It's still early, does anyone know a good bar nearby?").

Unlike many location-based services which work best for tourists and others unfamiliar with a city, Modo is targeted at local residents. Cockayne says that has a signif-

FIGURE 3: *Modo from Scout Electromedia.*

icant effect on the information presented. Residents know the general layout of a city so they can usually get by with address and cross street information, and they are particularly interested in other information relevant to the place under consideration. Each entry in Scout's database also has information such as the closest ATM, where and what the local parking is like, how to get there using public transit and additional places or events nearby.

Looking to the future, says Cockayne, "We are going to focus on delivering magical wireless," still concentrating on consumer applications. One area of particular interest is tower-based broadcasts. Paging carriers now allow messages to be broadcast from specific towers, so that, for example, a coupon for a bar could be sent only to devices within range of that tower. "The funny part is that the device hasn't actually been told the location, which is actually an unimportant piece of information at this point, but is able to seem really smart to the user," Cockayne notes.

Though they are delivering services to different platforms, there are interesting areas of overlap between Scout and Vindigo (SEE PAGE 13). Both are Flatiron portfolio companies, suggesting they are unlikely to compete directly, but each bears watching.

GeoVector: point and find

GeoVector is developing technology to allow handheld device users to receive information about something simply by pointing at it. The benefit, says coo Pam Kerwin, is that "it vastly reduces the number of clicks or scrolls or random choices that a user will have to make." GeoVector's interfaces identify objects using information about the device's location (from GPS or other mechanisms) and the direction in which it is being pointed (determined by internal sensors). The first GeoVector release uses a digital compass chip; future releases will also incorporate motion sensing.

GeoVector sees its technology enabling a variety of applications including mobile yellow pages, walking directions, location-aware instant messaging and travel guide. It will make APIs, user interface elements, database back-ends and development tools available to content providers who wish to incorporate this capability into their mobile offerings, and will also provide technology to chip and device manufacturers who will build it into their hardware.

GeoVector has been doing research and development on location-based technology for nearly a decade. The company was started by GRiD Systems founder John Ellenby, one of the pioneers of laptop computing, along with his two sons. While out sailing one day, so the story goes, Ellenby and his son Tom hit upon the idea of overlaying nautical mapping information on the field of view through a pair of binoculars, with the information corresponding to the direction someone was looking. They started GeoVector (originally called Criticom) to develop such technology; so far the company has filed for more than 30 US patents, eight of which have been granted.

GEOVECTOR INFO

HEADQUARTERS: San Francisco, CA
FOUNDED: 1990
EMPLOYEES: 5
FUNDING: $3 million from individuals including founders, former HP ceo John Young, Wit Capital ceo Bob Lessin, Excite svp Bill Foster, Xerox PARC director John Seely Brown and *Toy Story* producer Ralph Guggenheim
URL: www.geovector.com

Though it still plans to pursue the video overlay technology, GeoVector is focusing initially on delivering its direction-based interfaces on mobile devices. It has announced relationships with several location-oriented content providers including InfoUSA.com and XYPoint, and is in discussions with mobile handset vendors and carriers. Kerwin, who joined the company full-time from Pixar after initially being an investor, says consumer trials using the GeoVector technology should happen before the end of the year.

Without knowing what direction you're facing, a location-based application is forced to tell you about everything within a certain radius of your position, which can produce too many results. For example, there may be 10 Italian restaurants in the neighborhood, but you want the review of the one right in front of you. "We feel that the simplest, most straightforward way to access information is just to point at it, as you do in real life," explains Kerwin. Users can either set global preferences on their PCs (for example, don't ever show me information about fast-food restaurants in the direction I'm pointing, but always show me ATMs), or can specify categories through the device itself on a request-by-request basis.

"Carriers are interested in content, and also there's this buzz about location-based services, but nobody is quite sure about what customers will be interested in," Kerwin notes. GeoVector's primary business is licensing its designs to hardware, service and content providers, but to help seed the market it's prototyping ideas for content, advertising and promotions targeted by both location and direction. Think live scavenger hunts, virtual billboards, personalized travel guides and more. GeoVector is also working on technology to guide users to a destination with a flashing arrow that knows changes based on where you are and what direction you're facing, which is more intuitive than the usual "walk 200 feet north" instructions of computer-generated directions.

"Just to think that you can find out anything about anything in your world, to have that kind of information at your fingertips, would be wonderful," says Kerwin. Referring to the all-purpose sensor device from *Star Trek*, she concludes: "Maybe one day these phones will be known as the grandfathers of the tricorder."

Context-Sensitive Services: Spaces to Places

Space is an abstract concept based on physical dimensions and represented by maps. Places, on the other hand, are essentially contextual. (We lift this distinction, which traces its roots to Aristotle, from UCLA geography professor Michael Curry's paper, *New Technologies and the Ontology of Places*, which is available online at WWW.TAO.CA/WIND/RRE/0644.HTML.) What makes something a home, for example, is what you do there, not the exact dimensions or orientation of the physical facilities.

Some location-based services may be mobile but function only in particular defined environments. In other words, they can operate anywhere in space, but only make sense around the proper contextual places. We highlight two startups in this area, InfoMove and Televend. However, many other companies are working on context-sensitive technologies. Two particularly interesting areas of development are wearable computing (including MIT Media Lab spinoff Charmed Technology, which is merging wireless devices and fashion) and the integration of online and print content (such as the embedded bar codes, readable with special PC-connected scanning devices, that GoCode and Digimarc are placing in newspapers and magazines).

InfoMove: car-based services

Not all locations are equal. If you're sitting in a car, you have both different interface requirements and different forms of useful content compared to when you are standing on a street corner. Though it may not seem that way to those of us in New York City, Americans spend huge amounts of time in their cars — a total of 500 million hours per week. The average American worker commutes 43 minutes to work. InfoMove concentrates on location-based services for the automobile environment.

Peter Holland, the company's ceo, says the three key elements of in-car information services are automatic location detection, a wireless data connection, and aggregated content optimized for the car environment. Some information, such as traffic, is already available either through conventional radio or dial-up services, but it's much

WIDE OPEN SPACES?

Interoperability will be important for the growth of location-based services. No content or network provider will incorporate all the information people want. There will have to be ways to pass various kinds of data between different services.

The same issues about openness and standards arise in connection with voice portals (SEE **RELEASE 1.0**, MAY 2000). In some ways, though, seamless interconnection is even more important for location-based services. We expect the world to be continuous. If AI can read the menu posted outside a restaurant, Ethel should be able to find the hours the drugstore across the street is open.

Despite this, wireless carriers and content providers will doubtless try to capture users in self-contained bubbles of information. Traditional geographic information systems (GIS) applications, developed to analyze and visualize mapping data, have largely used proprietary or limited formats. Such approaches will only slow the growth of the new kinds of location-based services we describe in this issue. GeoDiscovery's GeoXML framework (SEE PAGE 7) offers an alternative based on the open XML protocol, and GeoDiscovery intends to publish the document type definition (DTD) so that third-party content providers can create compatible information.

GeoDiscovery has no specific plans to approach standards bodies, says vp of marketing Brian Sevy, because the resource investment doesn't make sense at such an early stage in the development of the market. However, he agrees standards will be critical to the eventual success of location-based Internet services.

more useful to receive dynamic, real-time, personal traffic reports based on current location and possible routes to your destination.

Existing vehicle-based systems, such as GM's Onstar and CD-ROM-based offerings, are not sufficiently flexible, scalable and dynamic, says Holland. By using a wireless data connection and integrated location determination through GPS or triangulation, InfoMove plans to deliver much more relevant and rich information.

InfoMove's core applications include real-time navigation (audible turn-by-turn directions, dynamically reconfigured based on your actions), real-time traffic (both incident information and general traffic flow on a route, as well as estimated time of arrival), vehicle diagnostics, and general information such as news and email access. By hooking into the car's diagnostic systems, InfoMove can, automatically notify a mechanic of the nature of a problem, allowing him or her to pre-order a part.

InfoMove is working with the University of Washington on enhanced predictive traffic modeling algorithms that fuse historical and current data. And the models could be refined over time using data collected by each car. "Each of these vehicles is a node for data collection," says Holland. In addition to traffic data, on-board location-sensitive systems could automatically and anonymously update central map databases. Holland also sees new messaging services integrated with location-based information, such as fleet dispatchers staying in touch with drivers.

INFOMOVE INFO

HEADQUARTERS: Kirkland, WA
FOUNDED: 1998
EMPLOYEES: 55
FUNDING: $8.9 million raised led by NTT, Infospace, Bsquare, Mitsui Comtek and individuals such as former Microsoft CFO Greg Maffei
URL: www.infomove.com

Some in-car information services will be built into the automobile itself, but in other cases users will get information through mobile phones or other devices they bring with them into the car. Holland says car manufacturers originally planned on building their own specialized hardware, but now are coming to favor a more flexible approach in which portable devices could interface with built-in screens and speakers. The major US auto manufacturers have agreed on the Automotive Multimedia Industry Consortium (AMIC) standard for high-speed in-vehicle LANs with up to 24 USB-like connectors. Combining those LANs with short-range wireless Bluetooth connections (SEE **RELEASE 1.0**, APRIL 1999) will make it possible for phones and other handheld devices to automatically interface with car-based systems.

InfoMove will private-label its services to auto makers, wireless carriers, device manufacturers and mobile portals. It will also aggregate existing content, such as that provided by InfoSpace, and deliver it to in-car users.

TeleVend: wireless vending machines and more

TeleVend, founded by five Israelis, has developed technology that allows people to purchase goods wirelessly through mobile phones, and have transactions automatically billed to prepaid accounts, credit cards or bank accounts. "We asked ourselves what was the killer application for mobile commerce," says cofounder Gedaliah Gurfein. "The answer we came up with was to turn the mobile phone into the smart card that no one has been able to make." The company says it can enable mobile commerce for everything from ATMs to gas pumps, as well as vending machines.

Take a McDonald's drive-through lane, for example. A customer could punch in an order on his or her phone, enter a PIN for security, and have the transaction cleared immediately. The food, along with a receipt, would be waiting when the customer reached the pickup window. This may not seem earth-shattering, but Gurfein argues that TeleVend's technology opens up a wealth of new commerce opportunities. For example, imagine when you walked into a Starbucks to purchase a frapuccino, Starbucks offered you a promotional discount through your mobile phone in real time based on your identity. "Suddenly [merchants] have an amazing ability to develop customer loyalty by being able to interact individually in real time with your customers," comments Gurfein.

This raises questions about privacy. Gurfein says TeleVend is very sensitive about such issues, but argues there's a difference between sending unsolicited messages and contacting users who enter a store to make a transaction: "If I have chosen to walk

into a Starbucks, it's fair to assume that if I get a call when I'm in the store, and it's related to my purchase habits, that's not spamming; that's good service."

TELEVEND INFO

HEADQUARTERS: Jerusalem, Israel, and New York, NY
FOUNDED: February 1999
EMPLOYEES: 30
FUNDING: Under $3 million from angels
URL: www.televend.com

Though TeleVend supports location-based transactions through merchants or vending machines, the intelligence and transaction processing in its system is handled through central servers. "The person feels he's calling the vending machine, when in fact he's calling the vending machine through our server," explains Gurfein. This architecture eliminates the need to retrofit site-based equipment, which would make deployment costs and other technical challenges overwhelming.

Vending machines and B2C retail environments are important to the company, but cto Terry Julius says the biggest opportunity for TeleVend long-term is in person-to-person (P2P) payments. Because the TeleVend system handles security and transaction clearing for live cash transactions using mobile phones as an interface, it can enable individuals to send money back and forth directly (for more on online payment systems, SEE **RELEASE 1.0**, OCTOBER 1999). TeleVend is in talks with various partners, and plans to launch its services in the US in September.

Putting the Space Back into Cyberspace

As location-based computing develops, its metaphors are feeding back into the virtual world. Two fundamental attributes of physical reality are depth and context. Human consciousness is only capable of processing a tiny sliver of the information our sensory organs receive. (For a fascinating exploration of this point, see Tor Norretranders' book, **THE USER ILLUSION**). We manage this difficulty by focusing on specific elements of the world around us, and letting everything else blur into the vague subconscious. But we can choose to focus on something else, or to focus more closely on what we're already concentrating on. In addition, wherever you are, you know there are larger frameworks, physical and conceptual, beyond the space you perceive. Everything has a context, not just a container but a set of pointers that eliminate ambiguities of meaning.

A raft of new applications attempts to bring the physical sensations of depth and context to the Web. GuruNet, Flyswat (now owned by NBCi) and Third Voice all provide a separate plane of contextual information in the form of a pop-up window

or a side pane in a Web browser. GuruNet goes even further and provides contextual information (dictionary definitions, encyclopedia entries, movie reviews, and so forth) for highlighted text in any Windows application. Over time, these services will become smarter and will increase the variety content they offer to users.

The idea of adding a sense of space to the online world shouldn't be taken too literally. Sure, the desktop metaphor of the Xerox Star, Apple Macintosh and Windows PC makes personal computing more comprehensible through allusions to physical items such as folders, documents and trash cans. But it's a metaphor, not an exact correspondence. Attempts to make the connections more literal, including Microsoft's ill-fated Bob user interface and the General Magic MagicCap platform, have generally failed to catch on.

Users understand that what they see on a computer screen is a sort of cartoon world, which resembles reality but never pretends to transcend the illusion. If an interface tries to hard to mirror real-world phenomena, it may even harm the user experience. I'd take Amazon.com over a 3D walkthrough of realistically rendered bookstore shelves any day.

Interface and device designers of the future will have to figure out how to navigate this fuzzy boundary with new tools such as handheld Internet appliances and GPS location detection. In location-based situations, computers are additive to physical reality. Users won't block out the rest of the world and navigate by computer alone; they will look to devices as tools to enhance what their senses tell them. At the same time, the presence of these tools will shape expectations and social conventions.

We think about time differently than our ancestors because so many of us wear wristwatches capable of measuring it accurately. What will change when Internet-connected mobile computing devices delivering location-oriented content and applications are as common as wristwatches? ■ R 1.0

COMING SOON

- Triumph of the Weblogs.
- Residential gateways.
- How safe is your site?
- The Net and education.
- Streaming applications.
- In-building broadband.

- And much more. . . (If you know of any good examples of the categories listed above, please let us know.)

At Last . . . Shrug: The Microsoft Verdict

BY KEVIN WERBACH

The response to Judge Thomas Penfield Jackson's order calling for a breakup of Microsoft was oddly muted. Stock markets, even Microsoft's own stock, barely hiccupped. Commentators speculated hyperbolically for a few days, then went back to work. Barely a week later, Microsoft was announcing a major new initiative, called .Net, to transform Windows into a central framework for Web applications. It's as though, after a two-year trial and the most sweeping antitrust remedy since the AT&T divestiture, nothing has changed.

Don't be fooled. It's true that the *legal* outcome of the case hardly matters. But that's because the damage has already been done. Microsoft's role in the industry has changed dramatically, and the antitrust trial is a major reason why. We therefore offer some thoughts, not about Microsoft's guilt or innocence, but about what the case means for the future of the company and the industry. (NOTE: ESTHER DYSON HAS COMMENTED ON THE CASE IN HER SYNDICATED COLUMN, AVAILABLE AT WWW.RELEASE1-0.COM.)

Microsoft is among the most successful corporate entities in the history of capitalism. It has weathered the Internet revolution remarkably well. Yet ceo Steve Ballmer felt the need to title his talk at this year's PC Forum "Will Microsoft Matter?" And it's a fair question. Many venture capitalists will tell you that three or four years ago they were careful to avoid any area where Microsoft was, or might soon be a competitor. Today they hardly care. The excitement these days swirls around startups such as Napster, Tellme, Red Hat and Google, and platforms such as the Palm, Linux and the RIM Blackberry. Even in its third revision, Windows CE has failed to catch on, and the response to other recent Microsoft initiatives has been lukewarm.

Much of this is the inevitable result of the Internet tidal wave. But it's more than that. The trial, and industry developments in response to it, have affected Microsoft in two key areas: people and speed.

People are the most valuable treasure in the technology industry because they are irreduceable, and thus immune from the cruel progression of Moore's Law. As computers automate tasks and turn everything else into a commodity, great people become the only way for companies to distinguish themselves. Microsoft, as it has grown, has focused increasing attention on its people. The company has flourished

in part because its soaring stock attracted the best and brightest, but money is only part of it. So many talented engineers and managers stayed at Microsoft long after becoming multimillionaires, because their jobs offered challenges of a scope no company could match and opportunities for their work to be used by millions.

The antitrust case has changed Microsoft's relationship to its people. Put simply, working there isn't as much fun as it used to be. Brad Silverberg, Greg Maffei, Pete Higgins, both Myrhvolds and many others have left over the past year. Microsoft employees may strenuously defend the company, but the pressure of having to do so constantly is bound to make that startup opportunity even more appealing. And the trial experience, plus the prospect of litigation stretching on for years, make it harder now for employees to convince themselves Microsoft's future is as bright as its past.

Microsoft's other obstacle is time. As the company itself argued during the trial, the technology industry moves extremely fast. Disruptive changes come along often, making it difficult for any company to stay on top for long. There are always competitors ready to undermine perfectly good business models in ways incumbents can't touch. Microsoft should know: It vanquished Netscape and WordPerfect by giving away products those companies relied on for revenues.

So why, prior to the trial, didn't anyone do the same thing to Microsoft by building a business that can give away an Office-compatible productivity software suite, for example? Partly because Microsoft has innovated when needed, but partly because Microsoft has so ruthlessly used its leverage with PC vendors, customers and partners through its licensing and negotiating practices. In effect, Microsoft slowed down the clock of change to the point where it could keep pace. It is precisely those tactics that will now be reined in, either through court-imposed conduct restrictions or simply because they must face public scrutiny. Microsoft is doing all the right things (launching initiatives in Web services, business-to-business, wireless and handheld markets); it's just no longer immune from gravitational forces.

Microsoft is still a great, great company. It has many of the best minds, products and software engineering resources in the industry. It's facing not a quick death, but a slow maturation. To bastardize a line uttered by Prince Feisal in *Lawrence of Arabia*, startups need the virtues of young men — courage and hope for the future — while mature companies require the vices of old men — mistrust and caution. IBM, AOL and Apple all showed that successful technology companies can overcome their midlife crises and prosper into middle age. Microsoft, though, has always defined itself as the opposite of those companies. It's time to look in the mirror. ■ R 1.0

A WORD ABOUT OUR NEW LOOK

Since 1983, when Esther Dyson took over the *Rosen Electronics Letter* from Ben Rosen and transformed a semiconductor investor newsletter into *Release 1.0*, much has changed. The world has changed, and the computer industry we cover has changed even more. *Release 1.0* has itself changed over its 17 years, shifting focus to stay on the cutting edge . . . wherever that turned out to be. Esther Dyson, still the leading force behind the publication, gradually turned over primary writing responsibilities to Jerry Michalski and then to Kevin Werbach. Our content has evolved as the number of startups and alternate information sources has skyrocketed.

Some things, though, haven't changed. EDventure Holdings remains committed to delivering content that is relevant, insightful and valuable to a special community of readers that includes many of the leading executives and thinkers of the new economy. We live or die based on the quality of our analysis, the conversations we stimulate with our audience, our uniqueness and ultimately the validity of our perspective. The appearance of *Release 1.0* has always reflected this commitment. We spend our time and resources on delivering the highest-quality content, not on ornamentation and slick design. The name says it all. We strive to make *Release 1.0* always topical, always fresh and ahead of the market even if that means going out on a limb.

The issue of *Release 1.0* in your hands looks different from all the ones before it. We didn't undertake this redesign lightly. In fact, it's our first visual alteration in nearly a decade, and our most significant ever. We made the change because we concluded that it would best serve you, our readers, for two reasons.

First, the layout and design of the publication should be as readable and legible as possible, and thanks to well-established advances in technology a cleaner, more professional look doesn't force us to change our production process in ways that would reduce the freshness of the content. If *Release 1.0* isn't an easy read, that should reflect the depth of its insight, not the length of its lines or the shape of its typefaces.

The second reason is that with this month's issue, *Release 1.0* is going electronic. We developed the new design simultaneously with a revamped Website that offers online delivery in Adobe Acrobat PDF format. If you're a subscriber, you should receive an email message, around the time this issue arrives in the mail, with your password to download the electronic version. *(If you don't, please contact Natasha Felshman at 1 (212) 924-8800 or natasha@edventure.com to make sure we have your correct email address.)*

As a publication about technology, it may seem strange that we have waited so long. But we have always avoided using technology for technology's sake. *Release 1.0* will never lend itself to quick scanning on a screen, let alone a mobile phone. Electronic delivery will help us get content to our increasingly mobile subscribers more quickly and more flexibly, but rest assured that we will continue mailing hard copies whether or not you download the electronic version.

In short, though it may look different, this is still *Release 1.0*, not *Release 1.1*. We encourage your feedback and ideas for further enhancements.

— Kevin Werbach, Daphne Kis and Esther Dyson

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Calendar of High Tech Events

2000

JULY 13-14 **THE WORKSHOP ON INTERNET-SCALE SOFTWARE TECHNOLOGIES (TWIST 2000)** - Irvine, CA. The tension between centralized and decentralized applications on the Internet. For information call 1 (949) 824-1357; fax 1 (949) 824-1715; email irus2@ics.uci.edu; www.isr.uci.edu/twist2000/.

JULY 15-18 **INTERNET SUMMIT** - Dana Point, CA. The Industry Standard's flagship event, hosted by Mary Meeker and Bill Gurley, returns for its second year. For more info, call 1 (800) 255-1444. K

JULY 15-18 **O'REILLY OPEN SOURCE SOFTWARE CONVENTION** - Monterey, CA. Come fuel the open source fire. Keynotes include Gregory Benford and Andy Hertzfeld. Call 1 (888) 844-7024; conferences.oreilly.com/oscon2000/.

AUGUST 1-2 **HERRING ON HOLLYWOOD** - Los Angeles, CA. Not E! ntertainment, but e-Hollywood! To register, call 1 (888) 286-2167; fax 1 (415) 788-8848; events@redherring.com.

AUGUST 1-6 **7TH INTERNATIONAL CONFERENCE ON THE SIMULATION AND SYNTHESIS OF LIVING SYSTEMS** - Portland, OR. Looking back and looking forward on artificial life research. For more info, call 1 (503) 788-6693; fax 1 (503) 788-6643; alife7@alife.org.

SEPTEMBER 6-9 **DEMO MOBILE** - Pasadena, CA. On the road again, I just can't wait to get on the demo road again. To hitch a ride, call 1 (800) 633-4312; email registrar@demo.com; www.demo.com/demo_conferences/demo_mobile.html.

SEPTEMBER 11-14 **FALL 2000 VOICE ON THE NET** - Atlanta, GA. Pulver.com's IP telephony juggernaut rolls on. For more info, 1 (631) 547-0800; fax 1 (631) 293-3996; www.pulver.com.

SEPTEMBER 13-15 **TELECOSM** - Lake Tahoe, CA. George Gilder and friends tackle the future of convergence. For more information, email conferences@forbes.com; https://www.forbes.com/conf/Telecosm2000/.

SEPTEMBER 23-25 **TELECOMMUNICATIONS POLICY ROUNDTABLE CONFERENCE** - Alexandria, VA. The premier gathering of telecom and convergence policy wonks. For information or to register call 1 (202) 452-9033; fax 1 (202) 296-7128; email tprc@ei.com; www.tprc.org/2000.htm. K

NOVEMBER 1-3 **EDVENTURE'S HIGH TECH FORUM** - Barcelona, Spain. Our 11th year in Europe. Call Daphne Kis, 1 (212) 924-8800; fax 1 (212) 924-0240; daphne@edventure.com. More info at www.edventure.com. E K

E Events Esther plans to attend.
K Events Kevin plans to attend.

Lack of a symbol is no indication of lack of merit. The full, current calendar is available on our Website, www.edventure.com. Please contact Joanna Douglas (joanna@edventure.com) to let us know about other events we should include.

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Every month you will now be able to access the electronic version of *Release 1.0* before you receive your print copy in the mail. Gain access to Esther's and Kevin's ideas quickly, and benefit from the search and archival features of electronic delivery.

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